WHAT IS CLAIMED IS:

1. An apparatus for canceling far end cross talk and intersymbol interference in

2 a communication network, the apparatus comprising:

3   a decision feedback equalizer operable to determine a multidimensional

4   steepest descent gradient to adjust matrix coefficients that are

5   proportional to estimates of

6
$$\frac{\partial e_n}{\partial Q_k^{i,j}} \text{, wherein } Q_k^{i,j} \leftarrow \left(Q_k^{i,j} - \mu \cdot (\frac{\partial e_n}{\partial Q_k^{i,j}}) \right)$$

1. 2. The apparatus as set forth in Claim 1, wherein:

2

3
$$\frac{\partial e_n}{\partial Q_k^{i,j}} = 2 \cdot \left(Z_n^i - X_{n-p}^i \right) \cdot Y_{n-k}^j .$$

4

1. 3. The apparatus as set forth in Claim 1, further comprising:

2 a vector data unit delay operator coupled to receive an input vector Y_n from a

3   communication channel;

4 a vector error scaling operator for generating an error signal proportional to the

5   difference between the output Z_n of the feedforward equalizer and the

6   input X_n to the communication channel;

7 a first matrix multiplication operator coupled to multiply input from the vector

8   data unit delay operator and the vector error scaling operator;

9 a matrix summation operator coupled to add the output from the first matrix

10   multiplication operator to the output from a matrix tap unit delay

11   operator, wherein the matrix tap unit delay operator receives input from

12   the matrix summation operator; and

13 a second matrix multiplication operator coupled to multiply input from the

14   matrix tap unit delay operator and the vector data unit delay operator,

15   thereby generating .

4. The apparatus, as set forth in Claim 3, wherein:

the vector data unit delay operator passes a data vector Y_n through a series of

unit delay operators to generate successive tap input data Y_n, Y_{n-1}, Y_{n-2}.

5. The apparatus, as set forth in Claim 4, wherein:

the first matrix multiplication operator receives the 1xN matrix Y_{n-k} from the

unit delay operator and multiplies it with the Nx1 matrix of scaled

vector error data $(Z_n - X_n)$ from the vector error scaling operator.

6. The apparatus, as set forth in Claim 3, wherein:

the matrix summation operator receives a NxN adjustment matrix from the

first matrix multiplication operator, adds the adjustment matrix to a

Q_{n-k} matrix from the matrix tap unit delay operator, and outputs a

corrected matrix Q_{n-k+1}.

7. The apparatus, as set forth in Claim 6, wherein:

the matrix tap unit delay operator receives the corrected matrix Q_{n-k+1} from the

matrix summation operator, and introduces a one cycle delay to

generate the Q_{n-k} matrix.

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